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EXPERIMENTAL INVESTIGATION ON BEHAVIOR OF SHEAR WALL ASSEMBLED WITH INTERLOCKING CONCRETE BLOCK

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ABSTRACT

This study describes the development of a new type of interlocking concrete masonry block to reduce weight based on topological optimization and new design pattern of experiments. The Concrete block wall is easily stacked and placed. Interlocking mortar less concrete block wall system was developed as a new structural component for masonry building construction. The interlocking mortar less block system will reduce the time and cost of construction. A new pattern was designed for Interlocking concrete block acting as the load bearing wall system is different from the block units are interconnected through the interlocking block. Hollow concrete blocks are produced to achieve the reduction in weight and to improve strength. The concrete blocks were shaped by certain design pattern which can align horizontally and vertically. Experimental done results obtained structural behaving well under compressive load.

Key words: Interlocking Concrete Block, Shear Wall Failure, Concrete Blocks, Interlocking Design Pattern, Axial Load (UDL)

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1. INTRODUCTION

Interlocking concrete block system used for walls of buildings, retaining walls and buildings. Brick/Hollow block are the most common types of masonry in use in industrialized nations. Concrete blocks are also masonry wall system typically used and low in development under construction process. Concrete blocks were high in compressive strength comparing to brick/Hollow blocks. Concrete blocks laid and aligned reduce the number of high wage usage

skilled labor required on a construction. When compared to conventional interlocking block construction, block a dry assembled and save a great deal of mortar.

2. EXPERIMENT STUDIES

2.1. Cement

Ordinary/Normal Portland cement is one of the most widely used types of Portland cement 53 grade was used. The cement satisfied the requirement of IS: 12269-1987 specification. The physical properties of cement listed in Table 1.

2.2. Fine Aggregates

The sand is used as fine aggregate, and it is collected from nearby areas. The sand has been sieved in 4.75 mm sieve as per IS 383-1970. The physical properties of fine aggregates listed in Table 1.

2.3. Coarse aggregates

The coarse aggregate is chosen by size as per IS 2386 (part I) 1963, surface texture characteristics of aggregate classified as in IS 383- 1970. The physical properties of coarse aggregate listed in Table 1.

2.4. Water

Ordinary/Normal tap water was tested and its pH value is 7. Used for both mixing the constituents of the casting blocks as well as for the curing of concrete blocks.

Table 1 Physical properties

Materials	Physical properties	Valve obtained
Cement	Consistency	31%
	Initial setting time	38 minutes
	Final setting time	540 minutes
	Specific gravity	3.15
Fine aggregates	Maximum size (mm)	< 4.75
	Specific gravity	2.6
	Fineness modulus	3.29
	Bulk modulus (Kg/m^3)	36%
Coarse aggregate	Maximum size (mm)	20
	Specific gravity	2.82
	Fineness modulus	3.61
	Bulk density (kg/m^3)	1744
	Crushing value	18.13%
	Impact value	12.85%

2.5 CONCRETE

The concrete mix used for the manufacturing of interlocking concrete blocks was M40 as per IS 10262

3. EXPERIMENTAL INVESTIGATION

The main features of interlocking blocks are as under:

- The interlocking concrete blocks were a very high compressive strength as compared to ordinary bricks/hollow.

- Reduction construction time: interlocking concrete block wall system can be assembled at least three times faster than conventional block construction.
- Completely reusable: the unique interlocking surface allows for totally disassemble rendering all of the components useful for other construction projects.
- Lower overall construction cost: A recent independent study indicated that overall masonry cost decreased 38% using interlocking concrete block wall system.
- The effective cost of one concrete block of the interlocking unit is much less than the brick/Hollow block covering up the same volume.

3.1. Interlocking Concrete Mold

Interlocking concrete blocks are cast using an iron mold shown in figure 1.

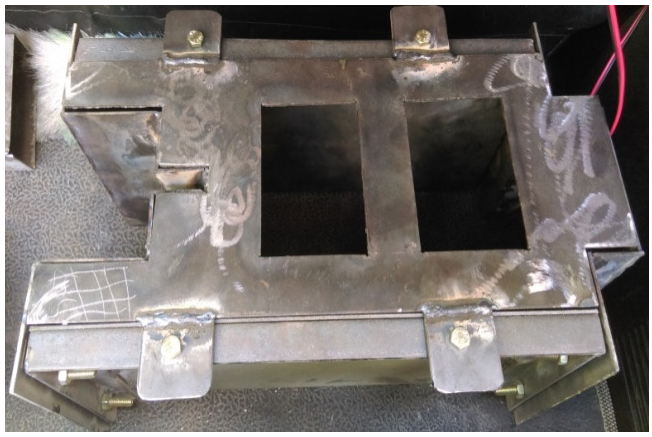
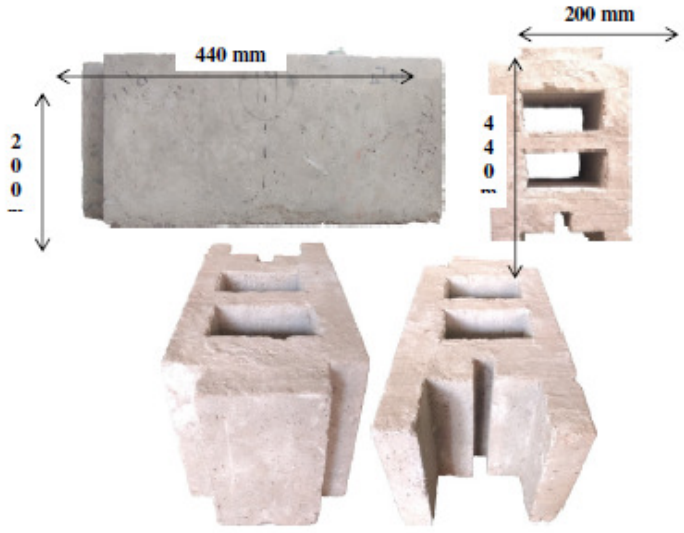
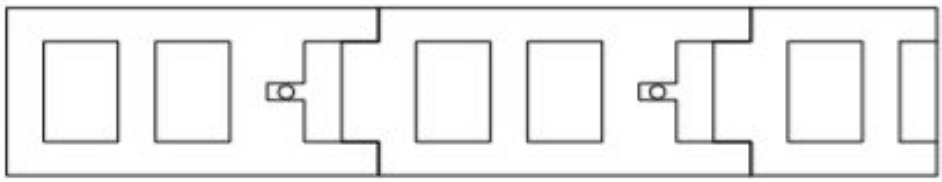


Figure 1 Interlocking iron mold

Concrete blocks design specific pattern, shape and sizes with dimensions of 440 mm × 200 mm × 200 mm (Figure 2). Concrete was made of Portland cement, sand and aggregate ratio with of 1:1.4:2.5. The selected ratio concreteblock considered to represent the work usually done shown in Figure 2. Concrete blocks were cured for 28 days from time period blocks are cast.



(A) Views interlocking block samples



(B) Arrangement of interlocking block

Figure 2 (A) & (B) Interlocking model configuration

4. EXPERIMENTAL TESTING PROGRAM

4.1. Compressive strength

The compressive strength test was done in compression testing machine and concrete cubes were placed between the jaws and the load should be applied gradually. M40 grade concrete cube (150 mm × 150 mm × 150mm) is placed on top flange and gradually load is applied over the complete area till the failure occurs and not the maximum load at failure (Figure 3). The load at failure shall be the maximum load at which the specimen fails to produce any further increase is the indicator reading on compression testing machine shown in Table 2.

Table 2 Compressive strength of cube (M40 grade)

Curing period	Compressive strength
7 days	34.67 Nmm^2
14 days	41.5 Nmm^2
28 days	52.15 Nmm^2

Figure 3 Compressive strength of cube (M40 grade)

4.2. Axial Load (Uniform Distributed Load) Testing

Figure 4 Interlocking concrete block wall

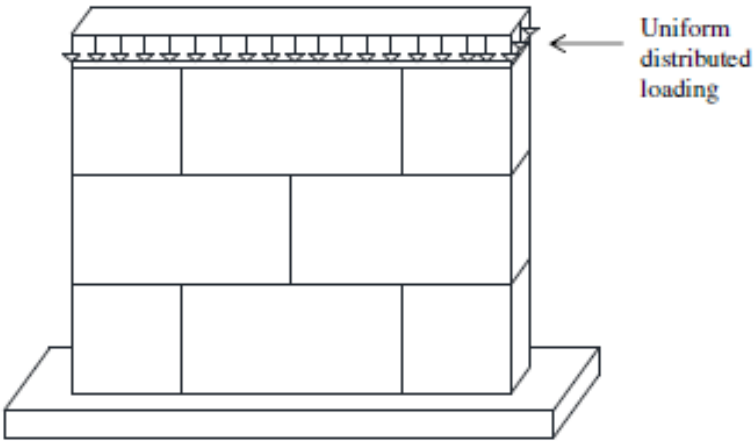


Figure 5 General view of interlocking concrete block wall for axial loading (UDL)

Cast interlocking concrete blocks cured normally for 28 days. Blocks are aligned horizontally and vertically to form a load bearing wall structure (Figure 4). Interlocking concrete block wall placed on the testing frame and applying an axial load (UDL) until shear wall failure shown in figure 5.

5. EXPERIMENTAL RESULTS AND DISCUSSION

Research results were presented in figure 6, failure of concrete blocks with a design pattern of the wall structure. Cracks were formed under load 90-100% of breaking load as shown in figure 6.

(A)

(B)

Figure 6 (A) & (B) Load at failure applying axial load (UDL) on an interlocking concrete block wall

Load deflection curves of the interlocking block wall obtained from the testing are shown in figure 7. The maximum forces of wall specimen Longitudinal deformation tell of sufficiently good mutual work of concrete block structure.

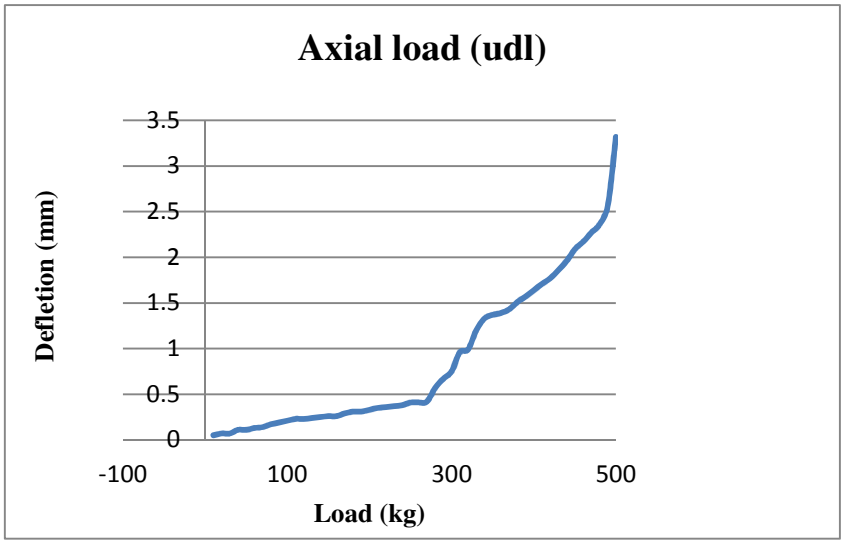


Figure 7 Results show that interlocking concrete block wall failure at maximum load of axial load (UDL) test

6. CONCLUSION

The Experimental study revealed that:

- The new design pattern was proved and acts as a concrete block wall structure.
- Interlocking concrete block wall system is efficiently used as a conventional load bearing wall.
- Interaction curves prove that interlocking concrete block wall failure at maximum load of axial loading test.

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